

Dinosaur bones have been dated by radiocarbon (Carbon-14)

Dates range from 22,000 to 39,000 years before present

The dates themselves are not as important as the fact that **there is measurable Carbon-14 in dinosaur bones**. If dinosaurs have been extinct for 65 million years, there should not be one atom of Carbon-14 left in their bones!

This is the data from the Paleochronology Group headed by Hugh Miller:

Dinosaur (a)	Lab/Method/Fraction (b,c,d)	C-14 Years B.P.	Date	USA State
Acro	GX-15155-A/Beta/bio	>32,400	11/10/1989	TX
Acro	GX-15155-A/AMS/bio	25,750 ± 280	06/14/1990	TX
Acro	AA-5786/AMS/bio-scrapings	23,760 ± 270	10/23/1990	TX
Acro	UGAMS-7509a/AMS/bio	29,690 ± 90	10/27/2010	TX
Acro	UGAMS-7509b/AMS/bow	30,640 ± 90	10/27/2010	TX
Allosaurus	UGAMS-02947/AMS/bio	31,360 ± 100	05/01/2008	CO
Hadrosaur #1	KIA-5523/AMS/bow	31,050 + 230/-220	10/01/1998	AK
Hadrosaur #1	KIA-5523/AMS/hum	36,480 + 560/-530	10/01/1998	AK
Triceratops #1	GX-32372/AMS/col	30,890 ±200	08/25/2006	MT
Triceratops #1	GX-32647/Beta/bow	33,830 +2910/-1960	09/12/2006	MT
Triceratops #1	UGAMS-04973a/AMS/bio	24,340 ± 70	10/29/2009	MT
Triceratops #2	UGAMS-03228a/AMS/bio	39,230 ± 140	08/27/2008	MT
Triceratops #2	UGAMS-03228b/AMS/col	30,110 ± 80	08/27/2008	MT
Hadrosaur #2	GX-32739/Beta/ext	22,380±800	01/06/2007	MT
Hadrosaur #2	GX-32678/AMS/w	22,990 ±130	04/04/2007	MT
Hadrosaur #2	UGAMS-01935/AMS/bio	25,670±220	04/10/2007	MT
Hadrosaur #2	UGAMS-01936/AMS/w	25,170±230	04/10/2007	MT
Hadrosaur #2	UGMAS-01937/AMS/col	23,170±170	04/10/2007	MT
Hadrosaur #3	UGAMS-9893/AMS/bio	37,660±160	11/29/2011	CO
Apatosaur	UGAMS-9891/AMS/bio	38,250±160	11/29/2011	CO

(a) Acro (Acrocantosaur) is a carnivorous dinosaur excavated in 1984 near Glen Rose TX by C. Baugh and G. Detwiler; in 108 MA Cretaceous sandstone – identified by Dr. W. Langston of Un. of TX at Austin.

Allosaurus is a carnivorous dinosaur excavated in 1989 by the J. Hall, A. Murray team. It was found under an Apatosaur skeleton in the Wildwood section of a ranch west of Grand Junction CO in 150 Ma (late Jurassic) sandstone of the Morrison formation.

Hadrosaur #1, a duck billed dinosaur. Bone fragments were excavated in 1994 along Colville River by G. Detwiler, J. Whitmore team in the famous Liscomb bone bed of the Alaskan North Slope – validated by Dr. J. Whitmore.

Hadrosaur #2, a duck billed dinosaur. A lone femur bone was excavated in 2004 in clay in the NW ¼, NE ¼ of Sec. 32, T16N, R56 E, Dawson County, Montana by the O. Kline team of the Glendive Dinosaur and Fossil Museum. It was sawed open by the O. Kline, H. Miller team in 2005 to retrieve samples for C-14 testing.

Triceratops #1, a ceratopsid dinosaur. A lone femur bone was excavated in 2004 in Cretaceous clay at 47° 6' 18" by 104° 39' 22" Montana by the O. Kline team of the Glendive Dinosaur and Fossil Museum. It was sawed open by the O. Kline, H. Miller team in 2005 to retrieve samples for C-14 testing.

Triceratops #2, a very large ceratopsid-type dinosaur excavated in 2007 in Cretaceous clay at 47° 02' 44N and 104° 32' 49W by the O. Kline team of Glendive Dinosaur and Fossil Museum. Outer bone fragments of a femur were tested for C-14.

Hadrosaur #3, a duck billed dinosaur. Scrapings were taken from a large bone excavated by Joe Taylor of Mt. Blanco Fossil Museum, Crosbyton TX in Colorado in Cretaceous strata.

Apatosaur, a sauropod. Scrapings were taken from a rib still imbedded in the clay soil of a ranch in CO, partially excavated in 2007 and 2009, in 150 Ma (late Jurassic) strata by C. Baugh and B. Dunkel.

(b) GX is Geochron Labs, Cambridge MA, USA; AA is University of Arizona, Tuscon AZ, USA; UG is University of Georgia, Athens GA, USA; KIA is Christian Albrechts Universität, Kiel Germany.

(c) AMS is Accelerated Mass Spectrometry; Beta is the conventional method of counting Beta decay particles.

(d) Bio is the carbonate fraction of bioapatite. Bow is the bulk organic fraction of whole bone; Col is collagen fraction; w or ext is charred, exterior or whole bone fragments; Hum is humic acids.

Bioapatite is a major component of the mineralised part of bones. It incorporates a small amount of carbonate as a substitute for phosphate in the crystal lattice.

Charred bone is the description given by lab personnel for blackened bone surfaces.

Collagen: Proteins that are the main component of connective tissue. It can be as high as 20% in normal bone but decomposes over time so that there should be none after ~100,000 years. Yet it is found in four-foot long, nine-inch diameter dinosaur femur bones claimed to be greater than 65 million years old. The "Modified Longin Method" is the normal purification method for bone collagen. Dr. Libby, the discoverer of Radiocarbon dating and Nobel Prize winner, showed that purified collagen could not give erroneous ages.

Commentary

Radiocarbon (RC) or Carbon-14 (C-14) dating of linen, cotton, bones, fossils, wood, sea shells, seeds, coal, diamond (anything with carbon) is one of the most common and well understood of the various scientific dating methods.

Carbon-14 is a radioactive isotope of carbon that is formed naturally in the atmosphere. All plants and animals have a regular intake of carbon while they are alive. When an animal or plant dies, it no longer takes in carbon of any form. C-14 has a half-life of 5730 years. The maximum theoretical detection limit is about 100,000 years, but radiocarbon dating is only reliable up to 55,000 years with the best equipment. Older dates are considered to be tentative. If, as generally believed, dinosaurs have been extinct for 65 million years, there should not be one atom of Carbon-14 left in their bones.

The accuracy of carbon dates depends on whether the ratio of Carbon-14 to Carbon-12 was the same in the past as it is today. Even with reliable results there is always a degree of uncertainty, and dates are usually given as +or- so many years.

There are two types of C-14 dating technologies. The original one, counting Beta decay particles, is a multistep process and requires sample sizes of several grams. The newer method of "Accelerator Mass Spectrometry" (AMS) requires smaller sample sizes and is more accurate. Beta counting is prone to possible errors in each of the many phases. AMS uses a much smaller sample size, and actually counts the Carbon-14 atoms as they are separated from the sample. The equipment accelerates streams of charged atomic particles to high velocities in order to sort and analyze them.

Carbon-14 dating of bone is one of the most difficult tasks in carbon dating, and requires the most care of any carbonaceous material. This is mainly due to the nature of bone, which is a very porous material. Certain parts of bone look like a sponge under the microscope. Many dinosaur bones are hard as rock because the original material has been replaced with a silicon material such as quartz. These are "mineralized" or "fossilized". We have found un-mineralized dinosaur bones. We then scrape the outer surface off to get rid of surface contamination, and date the inner remaining material. One can date just the purified bioapatite, the total organics, or the collagen, or a combination of these, as we did in several cases.

The discovery, and later confirmation, of collagen in a Tyrannosaurus-Rex dinosaur femur bone was reported in the journal SCIENCE. This is a remarkable find because collagen, being a soft tissue present in most animals, is supposed to decay in a few thousand years. Collagen is the main protein found in connective tissue of animals. It can make up as much as 1 to 6 percent of muscle mass. Triceratops and Hadrosaur femur bones in excellent condition were discovered in Glendive Montana, and our group

received permission to saw them in half and collect samples for Carbon-14 testing. Both bones were tested by a licensed lab for presence of collagen. Both bones did in fact contain some collagen.

The best process (Accelerator Mass Spectrometry) was used to date them. Total organic carbon and dinosaur bioapatite was extracted and pretreated to remove potential contaminants, and concordant radiocarbon dates were obtained. They were similar to radiocarbon dates for ice-age megafauna such as Siberian mammoths, saber tooth tigers of the Los Angeles LaBrea Tar pits, sloth dung, and giant bison. We usually prefer AMS dating because of its inherent superior accuracy, but use the conventional method when large samples are available in order to completely rule out contamination. This is recommended by a carbon-dating laboratory specialist.

Video: Carbon-dating dinosaur bones: <http://youtu.be/zvWdWbLcJvQ>

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John Michael Fischer
mike@newgeology.us